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⑭発明の名称　多孔スクリーン状金属材の表面に樹脂塗膜を形成する方法

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明　細　書

1.発明の名称

多孔スクリーン状金属材の表面に樹脂塗膜を形成する方法

2.特許請求の範囲

多孔スクリーン状の被処理金属材の表面に、着色樹脂塗料を塗布して第1の塗膜を形成する工程と、この第1の塗膜の表面に透過性の放射線硬化性樹脂塗料を塗布して第2の塗膜を形成する工程と、放射線を照射して第2の塗膜を硬化させる工程とからなる多孔スクリーン状金属材の表面に樹脂塗膜を形成する方法。

3.発明の詳細な説明

（産業上の利用分野）

この発明は、着色や防塵などのために多孔スクリーン状金属材の表面に塗布，形成する方法に係り、紫外線や電子線といった放射線で硬化反応する樹脂塗料（以下放射線硬化性樹脂塗料という）を使用して樹脂塗膜を形成するようにしたものである。

（従来の技術）

近年、女性向電気かみそり，高級電気かみそりのようなものでは、従来の金属その外刃に着色を施し、この色変えにより機種に変化を持たせ、購入者が自由に選択できるものを提供しようとする傾向にある。

（発明が解決しようとする問題点）

この着色方法としては、外刃のような多孔スクリーン状金属材の表面に、溶剤で希釈した着色樹脂塗料をディッピングや吹付塗布により塗膜を形成することが考えられるが、この方法では、塗料が通常の樹脂塗料であるので、金属材との耐剥離力は高いが、表面硬度が低いため、長期間の使用によってヒゲやセーターの毛玉等との接触により摩耗が進み傷つき易く、この傷により外観が汚くなる恐れがある。

このために通常の樹脂塗料を焼付塗装することにより若干の耐剥離性および硬度の改善が行えるが、電気かみそりや毛玉取り器等の多孔スクリーンタイプのシート状金属材では、熱容量

が小さいためそれ自体の温度が上昇し、結晶肥大化などの熱影響を受けやすく、特にシート状金属材がニッケルを用いた電気鋳造されたものでは、著しくもろいものとなる。

そこで、上記通常の樹脂塗料に代えて、短時間で硬化処理でき、また殆ど熱の加わらない硬化処理ができる放射線硬化性樹脂塗料を用いることが好ましい。

この方法によれば硬度が向上できて、耐摩耗性も改善できるものの、含有される着色用顔料に阻害され塗膜の深層部まで充分硬化させることができず、このためには顔料等の着色剤含有量を減らすことになり、所望の着色が得られないものである。

〔問題点を解決するための手段〕

この発明は、かかる事実に着目して成されたもので、多孔スクリーン状の被処理金属材の表面に、着色樹脂塗料を塗布して第1の塗膜を形成する工程と、この第1の塗膜の表面に透過性の放射線硬化性樹脂塗料を塗布して第2の塗膜を形成する工程と、放射線を照射して第2の塗膜を硬化させる工程とからなる多孔スクリーン状金属材の表面に樹脂塗膜を形成するようにしたものである。

〔実施例〕

つぎに、この発明の実施例を図面に基づき説明する。図面は被処理金属材として電気かみそりの外刃を例示している。この外刃1はニッケルまたはニッケルとコバルトの合金を用いて電気鋳造法で鋳造するか、あるいは極薄のステンレス板をプレス加工することによって多数の毛導入孔2と毛導入孔間のリブ部3とを有する多孔スクリーン状をなしており、該リブ部3の表面に着色、防錆のための樹脂塗膜4が形成されている。

第2図および第3図において、その樹脂塗膜4の成形に際しては、まずリブ部3の金属表面に1～2Hの鉛筆硬度を有する金属用の放射線硬化性樹脂塗料をスプレーガンで吹付塗布して第1の塗膜5を形成する。

この樹脂塗料は着色剤を含有しており、この第1の塗膜5は所望の着色を発するものであるが、この着色剤の影響により充分な硬化が得にくいものである。勿論この第1塗膜5は通常の着色樹脂塗料でも良い。次に第1塗膜5の表面に5～6Hの鉛筆硬度を有するプラスチック用の透光性の放射線硬化性樹脂塗料を同じくスプレーガンで吹付塗布して第2の塗膜6を形成する。しかるのち、放射線（紫外線または電子線）を照射して第2の塗膜6を瞬時に硬化させる、以上のようにしたものである。

したがって、第1塗膜5を着色して、その上面を第2塗膜6を透光性のものとしているので深みのある着色効果が得られるだけでなく、上層の第2塗膜6は深層部まで放射線が透過でき完全硬化状態が得られるので、充分なる表面硬度が得られ、耐摩耗性が向上する。

因みに、金属用の放射線硬化性樹脂塗料としては、例えばポリエステルをベースとしたアクリル－エポキシ樹脂塗料を使用し、プラスチック用の放射線硬化性樹脂塗料としては、例えばアクリル・ユステル系樹脂を使用する。

また、第2塗膜6にシリコーンオイルを0.5～5重量%、好ましくは1.5重量%ほど含有させておけば、ブリード現象により樹脂塗膜4の表面のスリック性を向上できて肌触りが良好なものになり、毛の導入効果も高まる。

またこのとき、第2の塗膜6の外表面は、第2図に示すごとくリブ部3の表面形状より大きく中央突出している。これは放射線硬化性樹脂塗料が多量の溶剤を必要とせず、高い粘性を有したまま硬化できるため中央突出形状を得ることが可能となり、このため毛導入孔2へのヒゲ等の導入効果を高め、肌や服地への当りを優しくし、傷付きを防止できるだけでなく、透過性を有しレンズ効果を発揮するため、奥深い着色が得られるのである。

以上述べたようにこの発明によれば、多孔スクリーン状の被処理金属材の表面に、着色樹脂塗料を塗布して第1の塗膜を形成する工程と、

この第1の塗膜の表面に透過性の放射線硬化性樹脂塗料を塗布して第2の塗膜を形成する工程と、放射線を照射して第2の塗膜を硬化させる工程とからなる多孔スクリーン状金属材の表面に樹脂塗膜を形成するようにしたので、所望の色を呈した金属材を得ることができ、殊に第2の塗膜が透過性を有しレンズ効果を発揮するので、深みのある着色を得ることができるとともに、仮えヒゲ等との接触により摩耗が生じても表面側の透明な第2塗膜がわずかに摩耗するだけであるため、着色第1塗膜は損なわれることもなく、寿命の長い着色金属材が得られる。

更に表面側の第2塗膜が放射線硬化性樹脂であるので、ヒゲ剃り用シェービングフォームや衣類の汚れ落し用ベンジン等の薬剤に対しても冒されることはなく、しかも第2塗膜は透過性を有するので短時間で完全硬化させることができ、多孔スクリーン状金属材の物性が熱的影響を受けることなく、充分な機械的強度を維持することができ、特に第2塗膜が多孔スクリーンのリブ部外表面形状より大きく中央突出した形状のものも簡単に形成することができ、外刃に応用した場合、ヒゲや毛玉等の毛の導入効果を高めるとともに、肌や服地への当りを優しいものとすることができ、本発明は電気かみそりや毛玉取り器の外刃に好都合である。

4.図面の簡単な説明

第1図は被処理金属材の一例を示す電気かみそりの外刃の展開平面図、第2図はこの発明の方法により得られた外刃の拡大断面図、第3図は第2図における一部拡大断面図である。

1…電気かみそりの外刃（被処理金属材の一例）、2…毛導入孔、3…リブ部、4…樹脂塗膜、5…第1の塗膜、6…第2の塗膜。

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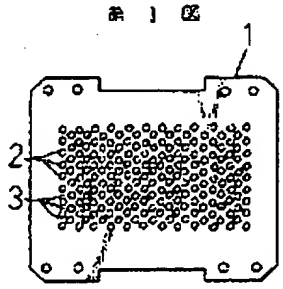
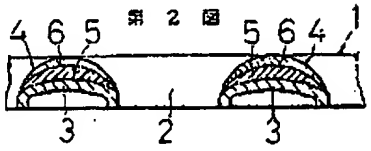
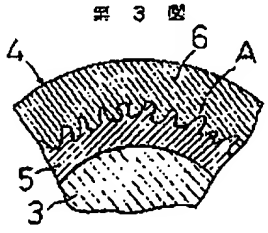
第1図



第2図



第3図



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(54) Title of the Invention: METHOD FOR FORMING RESIN COATING FILM ON SURFACE OF PERFORATED SCREEN-FORM METAL MEMBER

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SPECIFICATION

1. Title of the Invention

METHOD FOR FORMING RESIN COATING FILM ON SURFACE OF PERFORATED SCREEN-FORM METAL MEMBER

2. Claims

A method for forming a resin coating film on the surface of a perforated screen-form metal member, comprising a step in which a first coating film is formed by coating the surface of the perforated screen-form metal member that is being treated with a colored resin coating material, a step in which a second coating film is formed by coating the surface of this first coating film with a [light-]transmitting radiation-curable resin coating material, and a step in which the second coating film is cured by irradiation with radiation.

3. Detailed Description of the Invention

(Field of Industrial Utilization)

The present invention relates to a method for coating and forming [a film] on the surface of a perforated screen-form metal member for purposes of coloring or anti-rust protection, etc. This method is devised so that a resin coating film is formed using a resin coating material that undergoes a curing reaction [when exposed to] radiation such as ultraviolet light or an electron beam (hereafter referred to as a "radiation-curable resin coating material).

(Prior Art)

In recent years, in devices such as electric razors for women or high-class electric razors, coloring has been applied to conventional outer blades consisting of metals, and there has been a trend to provide products in which variations are introduced into product models by means of such color variations, and the purchaser can freely select [the desired product].

(Problems that the Invention is to Solve)

Conceivable methods for such coloring include methods in which a coating film is formed on the surface of a perforated screen-form metal member such as an outer blade by applying a colored resin coating material (diluted by means of a solvent) using a dipping or blow-coating technique. In the case of such methods, however, since the coating material is an ordinary resin coating material, the anti-peeling strength with respect to the metal member is high, but the surface hardness is low. Consequently, as a result of long-term use, wear progresses and

scratching tends to occur due to contact with whiskers or sweater lint balls, etc. Accordingly, there is a danger that the outward appearance will suffer by such scratches, etc.

Accordingly, a slight improvement in terms of peeling resistance and hardness can be obtained by baking an ordinary resin coating material. However, in the case of sheet-form metal members of the perforated screen type used in electric razors or lint removers, etc., since the thermal capacity is small, the temperature of [the member] itself rises, so that the member is susceptible to thermal effects such as crystal enlargement. Especially in the case of sheet-form metal members that are formed by electro-casting using nickel, [the members] become conspicuously brittle.

Accordingly, instead of the above-mentioned ordinary resin coating material, it is desirable to use a radiation-curable resin coating material that can be cured in a short time, and that allows a curing treatment in which almost no heat is applied.

If such a method is used, the hardness can be increased, and the wear resistance can also be improved. However, because of an impairment caused by the contained pigments used for coloring, sufficient curing cannot be obtained in the deep layer portions of the coating film. As a result, the content of the coloring agent (pigment, etc.) must be reduced, so that the desired coloring cannot be obtained.

(Means for Solving the Problems)

The present invention was devised in light of such facts. The present invention is devised so that a resin coating film is formed on the surface of a perforated screen-form metal member [by a method comprising] a step in which a first coating film is formed by coating the surface of the perforated screen-form metal member that is being treated with a colored resin coating material, a step in which a second coating film is formed by coating the surface of this first coating film with a [light-]transmitting radiation-curable resin coating material, and a step in which the second coating film is cured by irradiation with radiation.

(Embodiments)

Next, an embodiment of the present invention will be described based on the figures. The figures show the outer blade of an electric razor as an example of the metal member that is being treated. This outer blade 1 is formed as a perforated screen that has numerous hair introduction holes 2 and rib parts 3 between the hair introduction holes by casting by an electro-casting process using nickel or an alloy of nickel and cobalt, or by pressing an ultra-thin stainless steel

plate. A resin coating film 4 used for coloring and anti-rust protection is formed on the surfaces of the above-mentioned rib parts 3.

In Figures 2 and 3, when the resin coating film 4 is formed, a radiation-curable resin coating material (for use on metals) with a pencil hardness of 1 to 2 H is first applied to the metal surfaces of the rib parts 3 by blow-coating using a spray gun, so that a first coating film 5 is formed.

This resin coating material contains a coloring agent, so that this first coating film 5 shows the desired color. However, because of the effects of this coloring agent, it is difficult to obtain a sufficient hardness [in this coating film]. Of course, this first coating film 5 may also consist of an ordinary colored resin coating material. Next, a light-transmitting radiation-curable resin coating material (for use on plastics) with a pencil hardness of 5 to 6 H is similarly applied to the surface of the first coating film 5 by blow-coating using a spray gun, so that a second coating film 6 is formed. Afterward, the second coating film 6 is instantaneously cured by irradiation with radiation (ultraviolet light or an electron beam). [The present embodiment was carried out] as described above.

Accordingly, since the first coating film 5 is colored, and the upper surface is formed by the second coating film 6 with light-transmitting properties, a coloring effect with depth can be obtained. Moreover, since the upper-layer second coating film 6 can transmit radiation to the deep layer portions, a completely cured state can be obtained; accordingly, a sufficient surface hardness is obtained, so that the resistance to wear is improved.

Incidentally, an acrylic-epoxy resin coating material with a polyester base, for example, is used as the radiation-curable resin coating material for use on metals, and (for example) an acrylic-ester-type resin is used as the radiation-curable resin coating material for use on plastics.

Furthermore, if the second coating film 6 is caused to contain a silicone oil at the rate of 0.5 to 5 wt% (preferably approximately 1.5 wt%), the slickness of the surface of the resin coating film 4 can be improved as a result of the bleeding phenomenon, so that a good feeling on the skin can be obtained, and the hair introduction effect is also enhanced.

In this case, furthermore, as is shown in Figure 2, the outer surface of the second coating film 6 shows a greater central protrusion than the surface shapes of the rib parts 3. The reason for this is as follows: namely, the radiation-curable resin coating material does not require a large amount of solvent, and can be cured while still retaining a high viscosity, so that a central protruding shape can be obtained. Accordingly, the effect of introducing whiskers, etc., into the hair introduction holes 2 is heightened, and contact with the skin or clothing is made gentle.

Consequently, not only is it possible to prevent scratching, but [the coating film] has [light-]transmitting properties so that a lens effect is manifested, thus making it possible to obtain a deep coloring [effect].

In the present invention, as was described above, a resin coating film is formed on the surface of a perforated screen-form metal member [by a method] comprising a step in which a first coating film is formed by coating the surface of the perforated screen-form metal member that is being treated with a colored resin coating material, a step in which a second coating film is formed by coating the surface of this first coating film with a [light-]transmitting radiation-curable resin coating material, and a step in which the second coating film is cured by irradiation with radiation. Accordingly, a metal member showing a desired color can be obtained. In particular, since the second coating film has [light-]transmitting properties and exhibits a lens effect, coloring with depth can be obtained. Furthermore, even if wear should occur as a result of contact with whiskers, etc., the transparent second coating film on the surface side is only slightly worn; accordingly, there is no damage to the colored first coating film, so that a colored metal member with a long useful life can be obtained.

Furthermore, since the second coating film on the surface side consists of a radiation-curable resin, this film is not attacked by chemicals such as shaving foam used for shaving or benzene used for cleaning clothing. Moreover, since the second coating film has [light-]transmitting properties, complete curing can be accomplished in a short time, and the material properties of the perforated screen-form metal member are not subjected to thermal effects, so that a sufficient mechanical strength can be maintained. In particular, the second coating film can easily be formed as a film with a shape in which the central portions [of the rib parts] protrude further than the outer surface shapes of the rib parts of the perforated screen. Accordingly, in cases where [the present invention is] applied to the outer blade [of an electric razor], the effect of introducing hairs such as whiskers or lint balls can be heightened, and the contact with the skin or clothing can be made more gentle. Thus, the present invention is ideal for use in electric razors or lint removers.

4. Brief Description of the Drawings

Figure 1 is an unfolded plan view of the outer blade of an electric razor, showing one example of the metal member that is treated [in the present invention]. Figure 2 is an enlarged sectional view of an outer blade obtained by the method of the present invention. Figure 3 is a partial enlarged sectional view in Figure 2.

1... Outer blade of electric razor (one example of metal member that is treated); 2... Hair introduction holes; 3... Rib parts; 4... Resin coating film; 5... First coating film; 6... Second coating film.

Applicant: Kyushu Hitachi Maxell, Ltd.

Representative: Seigo Sato

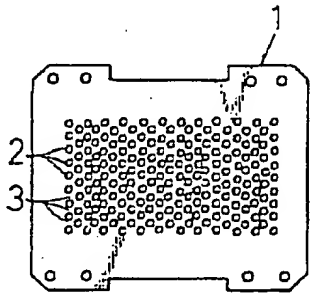

Figure 1

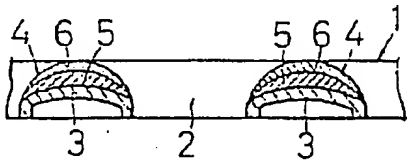

Figure 2

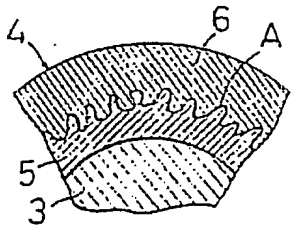

Figure 3